**ENCLOSURE 2**

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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| Report No.: | 50-416/97-01 |
| Licensee: | Entergy Operations, Inc. |
| Facility: | Grand Gulf Nuclear Station |
| Location: | Waterloo Road<br>Port Gibson, Mississippi |
| Dates: | March 3-7, 1997 |
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ATTACHMENT: Supplemental Information

## EXECUTIVE SUMMARY

Grand Gulf Nuclear Station
NRC Inspection Report 50-416/97-01

Grand Gulf Nuclear Station has developed and implemented a program in accordance with 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," with a few exceptions noted. The program generally followed the guidelines of NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 0, as described in Desk Top Guide DT-03-02, "Maintenance Rule Coordinator Desk Top Procedure," Revision 4.

### Operations

- The licensed senior reactor operators' knowledge, with respect to the Maintenance Rule, was commensurate with their Maintenance Rule responsibilities (Section O4).

- Operations personnel lacked sensitivity to assuring the tracking and evaluation of equipment unavailabilities and risk configurations. An inspection followup item was identified for tracking the licensee's actions related to accounting for equipment unavailability (Section M1.5).

### Maintenance

- The failure to have included three systems (i.e., communications, transient test, and turbine building ventilation) in the scope of the program from July 10, 1996, until February 25, 1997, was a noncited violation of 10 CFR 50.65(b)(2) (Section M1.1).

- The failure to assure that the performance criteria supported the assumptions used in the risk assessment was a noncited violation of 10 CFR 50.65(a)(2) (Section M1.2).

- The probabilistic risk assessment's level of detail, truncation limits, and quality were adequate to perform the risk categorization for implementing the Maintenance Rule (Section M1.2).

- The risk ranking methodology was appropriate and effectively utilized the Level 1 and 2 probabilistic risk assessments to establish performance criteria. The overall risk-ranking methodology, however, was lacking because it did not assess both the unavailability and reliability assumptions in the risk-ranking process (Section M1.2).

- With the exception of containment integrity and the containment structure, the expert panel had effectively integrated probabilistic risk assessment insights and deterministic approaches in establishing risk-significant structures, systems, and components (Section M1.2).

- The Maintenance Rule Program procedure appropriately established the requirements of 10 CFR 50.65(a)(3) to enable implementation of the periodic evaluation (Section M1.3).

- The licensee's method of balancing reliability and unavailability was appropriate, and had adequate procedural guidance and justification to be effective (Section M1.4).

- The licensee's process for the assessment of the safety impact of removing structures, systems, and components from service for monitoring and preventive maintenance was good (Section M1.5).

- A heightened sensitivity to risk-significant equipment being out-of-service had been appropriately established for the conduct of maintenance activities (Section M1.5).

- Additional training of operations and maintenance scheduling personnel and enhanced equipment out-of-service monitoring capabilities were both needed to effectively utilize the risk monitoring program capabilities (Section M1.5).

- In general, the licensee: properly established goals and performance criteria; performed appropriate monitoring and trending; and took appropriate corrective actions when required (Section M1.6).

- The failure to monitor availability of the instrument air system from July 10, 1996, to March 7, 1997, was a violation of 10 CFR 50.65(a)(2) (Section M1.6).

- Two risk-significant systems (i.e., nuclear boiler instrumentation and the control rod drive) were not monitored for availability from July 10, 1996, to February 25, 1997, and were a noncited violation (Section M1.6).

- The licensee's program for monitoring structures was not fully developed and implemented. Three concerns related to the program will be tracked by an inspection followup item (Section M1.6).

- In general, the material condition of the plant was very good (Section M2).

- The Maintenance Rule data base was lacking in some areas (i.e., errors, omissions, and inconsistencies) (Section M3).

Engineering

- The knowledge of the system engineers with respect to the Maintenance Rule was commensurate with their involvement in the program (Section E4.1).

## Report Details

Summary of Plant Status

The plant was operating at 100 percent power during this inspection.

## I. Operations

**O4 Operator Knowledge and Performance**

O4.1 Operator Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

The team interviewed senior reactor operators to determine if they understood the general requirements of the Maintenance Rule and their particular duties and responsibilities for its implementation. The team asked a sample of operators to explain the general requirements of the Maintenance Rule and to describe their responsibilities for implementing these requirements.

b. Observations and Findings

The team established that operations personnel had limited Maintenance Rule Program responsibility and that the senior reactor operators had received about 1 hour of training on the Maintenance Rule Program. The team observed that the majority of senior reactor operators interviewed were not generally knowledgeable of the Maintenance Rule Program, Maintenance Rule requirements, and probabilistic risk assessment concepts. The team found that the senior reactor operators did not fully understand the Maintenance Rule-related terms of scoping, risk-significance, monitoring period, and performance criteria as related to the program. However, these findings were not unexpected because of the heavy reliance on the Maintenance Rule coordinator and the way the licensee implemented the Maintenance Rule program.

The team noted that the control room operating crews were assigned responsibility for collecting out-of-service time for specific risk-significant structures, systems, and components. Senior reactor operators were also responsible for determining the change in risk associated with configuration changes due to emerging work or failures. Each senior reactor operator interviewed responded differently when queried on the process to be followed for assessing changes in total risk resulting from configuration changes that might occur during backshift. Issues related to these two areas are discussed later in the report.

c. Conclusions

The senior reactor operators' knowledge, with respect to the Maintenance Rule, was commensurate with their Maintenance Rule responsibilities.

## II. Maintenance

### M1 Conduct of Maintenance

M1.1 Scope of the System, Structure, and Component Functions Included Within the Maintenance Rule

a. Inspection Scope (62706)

The team reviewed the licensee procedure for initial scoping, the Grand Gulf Updated Final Safety Analysis Report, and emergency operating procedures. The team developed an independent list of structures, systems, and components that they determined should be included within the scope of the licensee's Maintenance Rule Program in accordance with the scoping criteria in 10 CFR 50.65(b). The team used this list to determine if the licensee had adequately identified the structure, system, and component functions that should have been included in the scope of the program.

b. Observations and Findings

The team did not identify any required structures, systems, or components that were omitted from the scope of the program developed for 10 CFR 50.65. The team did observe that three systems had been added to the scope recently by the licensee. The communications system, the transient test system, and the turbine building ventilation system were added as a result of the licensee's review of recent NRC inspection reports. These systems were added to the scope on February 25, 1997, and a historical review of their performance was performed.

The team found the failure of the expert panel to include the three systems within the scope of the Maintenance Rule from July 10, 1996, to February 25, 1997, to have been in violation of 10 CFR 50.65(b)(2). The team found that the licensee's actions upon identifying the omission of the systems were appropriate. The team also found that the omission of these systems did not have any effect with respect to the Maintenance Rule Program implementation.

c. Conclusions

The failure to have included the three systems in the scope of the program from July 10, 1996, until February 25, 1997, was a violation of 10 CFR 50.65(b)(2). This licensee-identified and corrected violation is being treated as a noncited violation, consistent with Section VII.B.1 of the NRC Enforcement Policy (50-416/9701-01).

M1.2 Safety or Risk Determination

a. Inspection Scope (62706)

Paragraph (a)(1) of the Maintenance Rule requires that goals be commensurate with safety. Additionally, implementation of the rule using the guidance contained in NUMARC 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 0, required that safety be taken into account when setting performance criteria and monitoring under paragraph (a)(2) of the Maintenance Rule. This safety consideration would then be used to determine if the structure, system, and component functions should be monitored at the train or plant level. The team reviewed the methods and calculations that the licensee had established for making these required safety determinations, including the probabilistic risk assessment and associated modeling. The team also reviewed the safety determinations that were made for the functions that were reviewed in detail during this inspection.

The team reviewed a sample of nonrisk-significant structures, systems, and components to assess if the safety-significance was adequately established.

b. Observations and Findings

The licensee had identified 28 of 135 structures, systems, and components within the scope of the Maintenance Rule as risk-significant. During the inspection, the licensee's Maintenance Rule expert panel changed the classification of component cooling water and plant service water systems to low risk-significant, leaving 26 systems, structures, and components as risk-significant. This reclassification was based on the licensee's updated probabilistic risk assessment results which did not identify either of these systems as being risk-significant.

The team observed that, overall, the probabilistic risk assessment model provided a comprehensive tool for assessing risk-significant components. However, the team noted that many of the balance-of-plant components were modeled as super-components (i.e., a combination of systems and/or components), or were not specifically considered. For example, the electro-hydraulic control system, which controls the turbine bypass valves and turbine control valves, was not modeled. The turbine bypass valves were modeled as a single common cause failure probability. The team also noted that other structures, systems, and components, including the turbine building cooling water and the associated dependencies with the instrument air system, were modeled. The team found that these modeling limitations were also reflected in the licensee's limited ability to model balance-of-plant components that were taken out-of-service as part of their equipment-out-of-service monitoring process (Section M1.5).

The team observed that the final risk-significance ranking was based on a combination of results from the probabilistic risk assessment importance measures and expert panel judgment. The team noted that the licensee's program used quantitative importance measures of risk achievement worth, risk reduction worth, and core damage contribution. The risk rankings were in terms of both core damage frequency (Level 1 analysis) and important systems for mitigating radioactive releases (Level 2 analysis). The team noted that the expert panel removed several systems, structures, or components from the list of risk-significant functions that were developed from the above probabilistic risk assessment activities. The team found that a system was classified as risk-significant, in part, if the system included a component that was necessary to support a risk-significant function.

The team observed that the Level 2 portion of the probabilistic risk assessment was used to identify risk-significant structures, systems, and components needed for containment integrity. Three of these systems (hydrogen igniters (E61); drywell, suppression and upper pool structure (M24); and, containment venting (M41)) were added for containment performance based on the expert's panel judgment and the Level 2 analysis. The team noted, however, the expert panel excluded containment integrity and containment structure from the risk-significant category, in part, because of the suppression pool scrubbing and the potential failure of the containment following a postulated severe accident.

The team determined that the function modeling in the probabilistic risk assessment for the sampled items was sufficiently detailed. In general, the expert panel appropriately considered the probabilistic risk assessment modeling limitations in assessing component and/or system risk-significance. Generic data was used to estimate reliability of various component types and failure modes. Specific data was used when statistically sufficient data was available.

The team identified the licensee's use of the updated probabilistic risk assessment in the ongoing evaluation of risk ranking and scoping of structures, systems, and components for the Maintenance Rule as a strength. This helped assure that the probabilistic risk assessment model provided the most accurate representation of systems and components for risk ranking. However, the team noted that five structures, systems, and components, which had been ranked as risk-significant, using the probabilistic risk assessment Level 1 and Level 2 risk ranking methodologies, were not identified as risk-significant by the expert panel. The expert panel had concluded that those structures, systems, and components were not risk-significant.

The basis for excluding the five structures, systems, and components from the risk-significant category was reviewed. The team determined that expert panel meeting minutes were not sufficiently detailed to provide the basis for removing the structures, systems, and components from the risk-significance category. The team subsequently met with the expert panel and discussed the panel's basis for excluding the structures, systems, and components. The team found that turbine building cooling water system, condensate system, and the drywell vacuum breakers were excluded based on sound probabilistic risk assessment and deterministic bases. The expert panel could not recall having discussed the risk-significance of the electro-hydraulic control system which is required for power operations and maintaining the main condenser available for decay heat removal following a transient. The licensee identified that this system, and many other balance-of-plant systems in the scope of the Maintenance Rule (a noted exception being instrument air), were not relied upon for the mitigation of severe accidents and were not considered risk-significant.

However, the team determined that, by excluding the containment integrity system (Mxx) and containment structure (M10), the expert panel did not effectively integrate the risk assessment insights for risk-significance into the calculation of the total contribution to core damage frequency and 10 CFR Part 100 type releases. The failure to include the M10 and Mxx structures, systems, and components as risk-significant was identified as a weakness in the evaluations performed by the expert panel.

The team assessed the truncation limits that were imposed on probabilistic risk assessment models to reduce the size and complexity of calculational results to a manageable level. The licensee used a truncation level of 1E-10 to quantify the probabilistic risk assessment model. This truncation level was less than the overall core damage frequency estimate of 2.43E-6 per reactor year. The team found this value to be adequate for the risk-ranking process.

Prior to the start of the inspection, the licensee determined that the established reliability performance criteria were not commensurate with the probabilistic risk assessment assumptions for acceptable limits of unreliability. For example, highly reliable structures, systems, and components such as the reactor protection system had less than four maintenance preventable functional failures per rolling 3-year period. The team noted that the licensee subsequently reevaluated the allowable maintenance preventable functional failures against the probabilistic risk assessment basis, and new allowable limits for maintenance preventable functional failures were established. Functions that were determined to be highly reliable, such as the reactor protection system, utilized a value of zero maintenance preventable functional failures.

The team noted that the licensee utilized the guidance provided in NUMARC 93-01, Section 9.3.2, to link the plant-specific probabilistic risk assessment with the performance criteria for risk-significant structures, systems, and components. In February 1997, the licensee performed individual sensitivity studies for each of the risk-significant systems to assess the impact on the core damage frequency if the plant was continuously operated at the level of system unreliability assumed by the performance criteria. The study used a cut set model to determine the core damage frequency. The licensee found that the base core damage frequency of 2.43E-6 doubled for the high pressure core spray system using a criterion of less than two maintenance preventable functional failures per cycle. Based on this finding, the performance criterion was changed to less than two maintenance preventable functional failures per two cycles. The remaining risk-significant systems were found to have acceptable performance criteria. The team found that these selections should preserve the assumptions used in the probabilistic risk assessment. The team found the licensee's reliability performance criteria to be acceptable.

The team found that the failure from July 10, 1996, to February 25, 1997, to establish performance criteria commensurate with the risk assessment was a violation of 10 CFR 50.65(a)(2). The team found that the licensee's completed actions (the reevaluation of the criteria and establishment of values consistent with the assumptions of the risk assessment) were adequate to correct the problem. The team noted that the licensee had additional actions to evaluate the effect of revising the performance criteria against the requirements of their Maintenance Rule Program (i.e., the determination of whether any system or component exceeded the new value and required evaluation in accordance with 10 CFR 50.65(a)(1)). The team found these actions to be appropriate to resolve this violation.

The team noted that unavailability criteria were established for all risk-significant systems and components. However, unavailability criteria had not been established for the instrument air (see Section M1.6), turbine building cooling water, and plant service water systems at a level that would monitor the effectiveness of maintenance performed on the respective pumps and compressors. The licensee representative stated that daily plant operation ensured that these systems were adequately monitored for the systems' risk-significance. The basis for this determination was that the instrument air compressors (backed up by service air) and turbine building cooling water were 100 percent capacity components and supplied a common header. For the plant service water system, the performance success criterion for a postulated severe accident, utilized in the probabilistic risk assessment modeling, was only one operating pump, which is less than the number of pumps required to operate the plant. In each case, the licensee considered the standby component to be a spare.

Specifically, the redundant components were operated as part of the equipment rotation process and were not treated as installed spares. Individual components could remain out-of-service for extended periods and not be identified at the system level provided the redundant component continued to operate. This could result in masking the effectiveness of maintenance activities. The team determined that monitoring these components at the system level did not monitor the effectiveness of maintenance performed on the individual pumps and compressors.

The licensee recently increased the time period that several risk-significant structures, systems, and components could be unavailable. The increase in core damage frequency, when all of the revised unavailability performance criteria were quantified in the probabilistic risk assessment model, resulted in a 23 percent increase in the baseline core damage frequency value. The licensee concluded that this was an acceptable risk increase. A similar assessment was not performed for the synergistic effects of the revised unavailability criteria with the revised reliability performance criteria. The team was concerned about the synergistic effect on risk ranking. The licensee's representative did not believe that combining the unavailability criteria along with the revised reliability performance criteria would provide meaningful information concerning risk ranking because not all systems would approach the unavailability guidelines or experience the degree of unreliability given by the revised reliability performance criteria during a cycle.

The expert panel was established in accordance with Section 9.3.1 of NUMARC 93-01. The expert panel membership included representatives from operations, maintenance, system engineering, design engineering, and nuclear safety and regulatory affairs. Alternates for each permanent member and rules for a quorum were established in the expert panel's charter.

The team determined that the licensee's program used quantitative measures of risk achievement worth, risk reduction worth, and cutsets contributing to 90 percent of calculated core damage frequency. The final risk-significance ranking was based on a combination of results from the probabilistic risk assessment and expert panel judgment, based on their deterministic considerations. The team noted that the accident sequence frequencies for dominant sequences in the probabilistic risk assessment model were uniformly distributed. Thus, the use of 90 percent core damage frequency cutset contribution as an importance measure would conservatively result in more structures, systems, and components being ranked as risk-significant. The expert panel members also indicated that their conclusions on structures, systems, and components importance were based on their engineering judgment and using the threshold criteria of any one of the risk-importance measures.

c. <u>Conclusions</u>

The failure to assure that the performance criteria supported the assumptions used in the risk assessment was identified as a violation of 10 CFR 50.65(a)(2). This licensee-identified and corrected violation is being treated as a noncited violation, consistent with Section VII.B.1 of the NRC Enforcement Policy (50-416/9701-02). The probabilistic risk assessment's level of detail, truncation limits, and quality were adequate to perform the risk categorization for implementing the Maintenance Rule. In general, the licensee's performance criteria for unavailability of risk-significant structures, systems, and components were commensurate with the probabilistic risk assessment assumptions.

The risk-ranking methodology was appropriate and effectively utilized the Level 1 and 2 probabilistic risk assessments to establish performance criteria. The overall risk-ranking methodology, however, was lacking because it did not assess both the unavailability and reliability assumptions in the risk-ranking process. With the exception of containment integrity and the containment structure, the expert panel had effectively integrated probabilistic risk assessment insights and deterministic approaches in establishing risk-significant structures, systems, and components.

M1.3 Periodic Evaluation

a. Inspection Scope (62706)

Paragraph (a)(3) of the Maintenance Rule requires that performance and condition monitoring activities and associated goals and preventive maintenance activities be evaluated taking into account, where practical, industry-wide operating experience. This evaluation is required to be performed at least one time during each refueling cycle, not to exceed 24 months between evaluations. The team reviewed the plans and procedures the licensee had established to ensure this evaluation would be completed as required. The team also discussed these plans with the licensee's Maintenance Rule coordinator who was responsible for performing this evaluation.

b. Observations and Findings

The team reviewed Procedure 17-S-03-28, "Maintenance Rule Program," Revision 1. The team found that the procedure established the periodic evaluation requirements commensurate with the requirements of 10 CFR 50.65(a)(3) and guidelines in NUMARC 93-01. The licensee was in the process of completing the evaluation which was initiated following the completion of the last refueling outage in December 1996.

c. Conclusions

No periodic evaluation had been performed since the implementation of the Maintenance Rule in July 1996. A procedure appropriately established the requirements of 10 CFR 50.65(a)(3) to enable implementation.

M1.4 Balancing Reliability and Unavailability

a. Inspection Scope (62706)

Paragraph (a)(3) of the Maintenance Rule also requires that adjustments be made, where necessary, to assure that the objective of preventing failures through the performance of preventive maintenance is appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance. The team reviewed the plans and procedures the licensee had established to ensure this evaluation will be completed, and the results of the recent balancing evaluation. The team discussed these issues with the licensee representative who was responsible for performing these evaluations.

b. Observations and Findings

The requirements for balancing reliability and unavailability were discussed in Procedure 17-S-03-028. The licensee had established unavailability criteria to limit the increase in core damage frequency to 23 percent. The licensee's approach for balancing unavailability and reliability consisted of monitoring performance against the established performance criteria.

The team found that appropriate reliability and unavailability criteria had been established for all but one system (instrument air). The team found that the licensee had not adequately established unavailability criteria for the instrument air system. As stated in Section M1.2, the team found that the unavailability for the instrument air system was monitored at the system level, not the component level, which precluded meaningful balancing of reliability and availability for the system (see Section M1.6.b. for further discussion).

c. Conclusions

The team concluded that the licensee's method of balancing reliability and unavailability was appropriate, and that it had adequate procedural guidance and justification to be effective. However, the failure to establish unavailability criteria at the train level for instrument air precluded meaningful balancing of reliability and availability for this system).

M1.5 Plant Safety Assessments Before Taking Equipment Out-of-Service

a. Inspection Scope (62706)

The team reviewed the licensee's process for assessing the impact of removing equipment from service to support maintenance activities. Paragraph (a)(3) of the Maintenance Rule states that the total impact on plant safety should be taken into account before taking equipment out-of-service for monitoring or preventive maintenance. The team reviewed the licensee's procedures and discussed the process with the Maintenance Rule coordinator, the expert panel members, operators, and maintenance schedulers. A sample of plant configuration changes that resulted from schedule changes and equipment failures was reviewed. The team then evaluated the licensee assessment of the difference in risk as a result of the changes.

b. Observations and Findings

The licensee imposed the requirement to assess the impact on plant safety when removing equipment from service in accordance with Administrative Procedure 01-S-18-1, "Work Planning and Coordination," Revision 0. This administrative procedure stated that qualitative and quantitative reviews were required on proposed work schedules to verify that the scheduled activities did not present unacceptable risk to either personnel or plant safety. This procedure was applicable during plant operations and planned forced outages.

In February 1997, the equipment out-of-service monitor, which is a software code for calculating core damage frequency estimates of equipment outage configurations, was installed in the control room as an advisory tool for operations to evaluate the risk impact of changing plant configuration to support maintenance. The team was not able to assess the effectiveness of this risk tool by the operations staff because of the limited time and training the operators had with its use. The team noted that the equipment out-of-service monitor was capable of providing backshift operations personnel (who have limited support staff) with a method to assess the change in risk associated with emergent work or equipment failure, determine if ongoing tasks should be postponed, or which components should be returned to service first (risk reduction worth) to achieve the greatest risk benefit. The team noted that, although the equipment out-of-service monitor program was capable of providing this type of risk information, the licensee had not provided training to the operations and maintenance planning staff on its use in this capacity.

The equipment out-of-service monitor used four risk levels (designated by green, yellow, orange, and, red colors) ranging from a baseline plant safety index of 10 to 0, to identify safety impact. The orange condition indicated high risk level and senior management approval was required before voluntarily entering into the condition. Voluntary entry into the red condition was prohibited. Interviews with various plant staff personnel reflected a conservative approach to the removal of equipment from service during power operation. The team noted that the balance-of-plant systems were essentially modeled as super-components in the equipment out-of-service model. This precluded risk evaluations on many balance-of-plant components that may be taken out-of-service along with previously identified risk-significant components. Discussions with maintenance planning personnel indicated that the probabilistic risk assessment group was consulted when configuration concerns (emergent work and equipment failures) were identified that appeared to be outside the modeling capabilities of the equipment out-of-service monitor. Guidance in this area had not been proceduralized.

The team noted that a truncation level of 5E-9 was used in the equipment out-of-service monitor to speed up the risk calculations of various configurations. Additionally, the probabilistic risk assessment model implemented in the equipment out-of-service monitor was modularized such that single basic events on the same train were modularized into a super-component, and each calculation was a full requantification of the risk model. Previous system configurations were stored in the equipment out-of-service program for quick recall.

The team interviewed scheduling personnel to evaluate the process of assessing risk associated with the maintenance work activities scheduled in the 12-week rolling schedule. Equipment out-of-service monitor risk assessments on the scheduled activities (frozen 2 weeks prior to the work implementation week) were initiated at 4 weeks prior to the work week to allow making decisions on changes to the work schedule if high risk configurations were encountered. A licensee representative indicated that the probabilistic risk assessment group would be requested to assess equipment out-of-service calculations which were beyond the modeling scope of equipment out-of-service monitor to assure the adequacy of the risk results for scheduling plant activities. The licensee also used the outage risk assessment management computer code to evaluate the risk of plant configurations during outages.

The team reviewed operation's clearance order and equipment out-of-service logs to identify risk-significant "time windows" in which structures, systems, and components were out-of-service and to verify that risk-significant component unavailabilities were being assessed. The team identified three instances involving unavailabilities for the B diesel driven fire pump on January 17, 1997, the A emergency diesel generator on January 29, 1997, and the A standby gas treatment system on January 30, 1997, for which their unavailability periods had not been tracked against the allowable unavailability period. The team noted that these periods did not cause the systems to exceed their stated unavailability performance criteria. The licensee initiated a condition identification to review clearance order and equipment out-of-service logs to identify any other examples and take appropriate corrective actions. This was identified as an inspection followup item.

In the case of the A Emergency Diesel Generator, the team found that a plant safety index had not been calculated for the emergency diesel generator's time out-of-service. The licensee performed the risk assessment using equipment time out-of-service and calculated a plant safety index value of 8.3. This placed the plant into a yellow condition. No specific actions were required by this risk determination of the plant in the yellow condition. In this case, the work activity was performed by nuclear plant engineering, but was not evaluated in the planning process by maintenance scheduling personnel for risk importance.

c. <u>Conclusions</u>

The team determined that the licensee's process for the assessment of the safety impact of removing structures, systems, and components from service for monitoring and preventive maintenance was good. A heightened sensitivity to risk-significant equipment being out-of-service had been established for the conduct of maintenance activities. However, additional training of operations and maintenance scheduling personnel, and enhanced equipment out-of-service monitoring capabilities were needed to effectively utilize the risk monitoring program capabilities. Operations personnel lacked sensitivity to assuring the tracking and evaluation of equipment unavailabilities and changing risk configurations. An inspection followup item was identified for tracking the licensee's actions related to accounting for equipment unavailability (50-416/9701-03).

## M1.6 Goal Setting and Monitoring and Preventive Maintenance

### a. Inspection Scope (62706)

The team reviewed program documents and records in order to evaluate the process that had been established to set goals and monitor under paragraph (a)(1) and to verify that preventive maintenance was effective under paragraph (a)(2) of the Maintenance Rule. The team also discussed the program with the Maintenance Rule coordinator, system engineers, plant operators, and schedulers.

The team reviewed the systems and components listed below to verify: that goals or performance criteria were established with safety taken into consideration; that industry-wide operating experience was considered for goal setting, where practical; that appropriate monitoring and trending was performed; and that corrective action was taken when a structure, system, or component function failed to meet its goal or performance criteria, or experienced a maintenance preventible functional failure.

- B33 Recirculation System
- C11 Control Rod Drive Hydraulic System
- C71 Reactor Protection System
- E12 Residual Heat Removal System
- E21 Low Pressure Core Spray System
- E30 Suppression Pool Makeup System
- L21 125 V Switchgear and Distribution Panels
- Mxx Containment Isolation System
- N19 Condensate System
- N21 Feedwater System
- P41 Standby Service Water System
- P75 Division I/II Standby Diesel Generators
- P81 High Pressure Core Spray Diesel Generator
- T46 Engineered Safety Feature Electrical Switchgear Cooling System
- Structures

### b. Observations and Findings

The Maintenance Rule, as implemented using the guidance in NUMARC 93-01, requires that safety (risk) be taken into consideration when establishing goals under paragraph (a)(1) or performance criteria under paragraph (a)(2). The team observed that the licensee had properly established goals for those systems, structures, or components that were either in, or had been in, the Category (a)(1).

The licensee had two systems in Category (a)(1) that provided high risk-significant functions. The licensee did not use the run to failure or inherently reliable classification for any structure, system, or component function. Therefore, goals were established for both of the systems' functions.

The licensee's expert panel used the risk determination process described in Section M1.2 above to assess the relative risk of all structures, systems, and components within the scope of the Maintenance Rule. The results of this process were used to categorize structures, systems, and components as either risk-significant or low risk-significant. System or train-level performance criteria were established for nearly all risk-significant structures, systems, components, and those nonrisk-significant systems that were classified in standby service.

The team determined that the licensee had not monitored the nuclear boiler instrumentation or the control rod drive systems (both risk-significant systems) for availability on a system or train level from July 10, 1996, to February 25, 1997. However, on February 25, 1997, the licensee determined that monitoring on the system/train level was appropriate. The team found the failure to have adequate performance criteria for monitoring the availability of these two systems was a violation of 10 CFR 50.65(a)(2). The team noted that the licensee had provided adequate monitoring criteria upon identification of the issue, and had commenced monitoring of the systems. The team also noted that the licensee was in the process of reviewing equipment histories to determine if any actions would be required to comply with their Maintenance Rule Program. The team found the completed actions, as well as those ongoing actions, to be appropriate to address this violation.

The team determined that the licensee had initially identified the reactor protection system as low risk-significant, but reclassified it as risk-significant on the basis of the updated probabilistic safety assessment. When this reclassification was made, the licensee determined that monitoring should be conducted at the channel level.

The team also noted that the instrument air system was classified as risk-significant, but had been monitored at the plant level (as discussed in Section M1.4, above) since July 10, 1996. This constituted a violation of 10 CFR 50.65(a)(2). When the team identified this to the licensee, the expert panel met to evaluate the risk-significant classification. When the panel reconfirmed the risk-significance of the instrument air system on March 6, 1997, the Maintenance Rule coordinator informed the team that the instrument air system would be monitored on the component level for availability and that they would review the equipment history to determine if any further action was required. The team found these actions to be appropriate to address this violation.

Plant-level performance criteria were appropriately established for all other in-scope structures, systems, and components, i.e., nonrisk-significant, normally-operating systems.

With respect to structures, the team noted that the licensee monitored the Maintenance Rule performance of structures in accordance with Program Plan GGNS-C-399.0, "Maintenance Rule for Structures," Revision 1. The licensee used existing programs to perform a baseline inspection of the structures that were in the scope of the licensee's Maintenance Rule Program. The inspections were approximately 90 percent complete and deficiencies had been identified for each structure. However, the licensee had not initiated any evaluation or repair of the identified deficiencies. A licensee representative indicated that deficiencies would be addressed when the inspection reports were final and approved.

The team identified the following concerns from the review of the licensee's procedural requirements for monitoring structures:

- The guidance did not provide instructions for scoping of structures into the Maintenance Rule Program. The structures determined to be in-scope were identified in the procedure, but there were no bases for including structures into or excluding them from the scope of the program.

- The procedure did not assign a risk-significance category to the in-scope structures. According to a licensee representative, structures were highly reliable, unlikely to fail, and therefore, nonrisk-significant.

- The procedure provided for inspection of structure conditions to be monitored, but did not provide a link between conditions monitored and performance criteria. A structure could not be placed in Category (a)(1) and goals set unless a catastrophic failure occurred.

The Maintenance Rule, as implemented using the guidance in NUMARC 93-01, requires that industry-wide operating experience be taken into consideration, where practical, when establishing goals under paragraph (a)(1). The team found that industry operating experience was considered for the establishment of goals and performance criteria.

The licensee had assigned the responsibility for trending and evaluating the performance of system-related functions to the Maintenance Rule coordinator.

c. <u>Conclusions</u>

The team concluded that, in general, the licensee: properly established goals and performance criteria; performed appropriate monitoring and trending; and took appropriate corrective actions when required. The failure to monitor availability of the instrument air system from July 10, 1996, to March 7, 1997, was a violation (50-416/9701-04); however, no response is required as the result of the licensee's corrective actions. The other two risk-significant systems that were not monitored for availability from July 10, 1996, to February 25, 1997, are considered to be licensee-identified and corrected violations and are being treated as a noncited violation, consistent with Section VII.B.1 of the NRC Enforcement Policy (50-416/9701-05). In order to complete this inspection, the three concerns (as discussed above) related to the licensee's program for monitoring of structures was identified as an inspection followup item (50-416/9701-06).

## M2 Maintenance and Material Condition of Facilities and Equipment

a. Inspection Scope (62706)

In the course of verifying the implementation of the Maintenance Rule using Inspection Procedure 62706, the team performed in-plant walkdowns to examine the material condition of the following systems and components:

- B33 Reactor Recirculation System
- C11 Control Rod Drive Hydraulic System
- E21 Low Pressure Core Spray System
- L21 125 V Switchgear and Distribution Panels
- Mxx Containment Isolation System
- N19 Condensate System
- N21 Feedwater System
- P41 Standby Service Water System
- P75 Division I/II Standby Diesel Generators
- P81 High Pressure Core Spray Diesel Generator
- T46 Engineered Safety Feature Electrical Switchgear Cooling System

b. Observations and Findings

The team found that the systems inspected were generally free of corrosion, oil leaks, water leaks, trash, etc., and appeared, based on their external condition, to be well maintained. For those exceptions (e.g., a grease spot on the floor in the condenser bay), the licensee had either previously identified the condition, or initiated a condition report after identification of the item by the team and the accompanying system engineer.

c. Conclusions

In general, the material condition of the plant was very good.

## M3 Maintenance Procedures and Documentation

a. Inspection Scope

The team reviewed the Maintenance Rule data base that was maintained by the Maintenance Rule coordinator for its contents.

b. Observations and Findings

The team observed that many (17 of 52) of the structures, systems, or components were erroneously identified as being monitored at the plant level, when, in fact, they were being monitored at the system, train, or component level. The team also observed that the data base did not include the identification of some system functions and boundaries. For example, the information for the 125 V switchgear and distribution panels did not include all the trains subject to the Maintenance Rule in the boundaries of the system (e.g., balance-of-plant trains required for emergency operating procedures). For the same system, the information did not include all the functions enveloped by the Maintenance Rule (e.g., seismic requirements and electrical separation). Additionally, the team observed that the data base was inconsistent in the information provided for structures, systems, and components that had transitioned from Category (a)(2) to Category (a)(1) and back. For example, the information for the containment isolation system did not clearly identify what actions were taken to correct the problem that placed the system in Category (a)(1), did not clearly identify when the system met the performance goals and transitioned back to Category (a)(2), and did not include all failures experienced during the last refueling outage.

The team found that the data base contained errors, omissions, and inconsistencies; however, none of these deficiencies constituted a regulatory concern. The team found the Maintenance Rule coordinator receptive to these comments. The Maintenance Rule coordinator indicated to the team that these deficiencies would be corrected.

c. Conclusions

The team concluded that the data base was lacking in some areas because of the lack of correctness, content, and consistency.

## III. Engineering

### E2 Engineering Support of Facilities and Equipment

### E2.3 Review of Updated Final Safety Analysis Report (UFSAR) Commitments

A recent discovery of a licensee operating their facility in a manner contrary to the UFSAR description highlighted the need for a special focussed review that compares plant practices, procedures and/or parameters to the UFSAR descriptions. While performing the inspections discussed in this report, the team reviewed the applicable portions of the UFSAR that related to the areas inspected. The team verified that the UFSAR wording was consistent with the observed plant practices, procedures and/or parameters.

## E4 Engineering Staff Knowledge and Performance

### E4.1 Engineering Staff Knowledge of Maintenance Rule

a. Inspection Scope (62706)

The team interviewed engineering personnel to assess their understanding of the Maintenance Rule and associated responsibilities. The team also reviewed the training that had been administered to system engineering personnel.

b. Observations and Findings

The team identified that system engineering personnel had minimal responsibility associated with Maintenance Rule activities. During interviews, a majority of system engineers were unfamiliar with Maintenance Rule activities or terms related to scoping, risk-significance, performance criteria, monitoring periods, or goal setting. Some system engineers did not know the performance criteria for their assigned systems. Most system engineers were unfamiliar with the requirements for monitoring under Category (a)(1) or returning a system to monitoring under Category (a)(2). Additionally, system engineers were not conceptually familiar with probabilistic risk assessment or the insights used to implement the Maintenance Rule. This lack of knowledge was not unexpected considering how the licensee had implemented the program, with heavy reliance on the Maintenance Rule coordinator. The team did not identify any concerns with the system engineers' knowledge of their assigned systems and the current conditions and issues associated with those systems.

c. Conclusions

The knowledge of the system engineers with respect to the Maintenance Rule was commensurate with their involvement in the program.

## V. Management Meetings

### X1 Exit Meeting Summary

The team discussed the progress of the inspection on a daily basis and presented the inspection results to members of licensee management at the conclusion of the inspection on March 7, 1997. In addition, a supplemental telephonic exit was held on March 25, 1997, to discuss the enforcement findings from the inspection. The licensee acknowledged the findings presented and stated that they would review the issues to determine if they had any differing positions.

The team asked the licensee staff and management whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

# ATTACHMENT

## SUPPLEMENT INFORMATION

## PARTIAL LIST OF PERSONS CONTACTED

Licensee

D. Bost, Director, Design Engineering, Entergy Operations Incorporated
C. Bottemiller, Supervisor, Operational Events
W. Brice, Engineer, Nuclear Safety and Regulatory Affairs
J. Burton, Manager, Nuclear Plant Engineering, Entergy Operations Incorporated
W. Eaton, General Manager
T. Errington, Engineering Support Superintendent
K. Fili, Supervisor, Engineering Support
W. Hughey, Director, Nuclear Safety and Regulatory Affairs
E. Rogers, Project Manager, Echelon
T. Thurmon, Senior Engineer

NRC

D. Powers, Chief, Maintenance Branch
K. Weaver, Resident Inspector

## INSPECTION PROCEDURES USED

| | |
|---|---|
| IP 62706 | Maintenance Rule |
| IP 62002 | Inspection of Structures, Passive Components, and Civil Engineering Features at Nuclear Power Plants |

## ITEMS OPENED AND CLOSED

Opened

| | | |
|---|---|---|
| 416/9701-01 | NCV | Failure to include three systems in the scope of the Maintenance Rule (Section M1.1) |
| 416/9701-02 | NCV | Failure to demonstrate that performance criteria were commensurate with the assumptions of the risk assessment (Section M1.2) |
| 416/9701-03 | IFI | Tracking licensee actions related to equipment unavailability (Section M1.5) |
| 416/9701-04 | NOV | Failure to adequately monitor unavailability for the instrument air system (Section M1.6) |

| | | |
|---|---|---|
| 416/9701-05 | NCV | Failure to adequately monitor unavailability for two systems (Section M1.6) |
| 416/9701-06 | IFI | Structures Monitoring Program (Section M1.6) |

<u>Closed</u>

| | | |
|---|---|---|
| 416/9701-01 | NCV | Failure to include three systems in the scope of the Maintenance Rule (Section M1.1) |
| 416/9701-02 | NCV | Failure to demonstrate that performance criteria were commensurate with the assumptions of the risk assessment (Section M1.2) |
| 416/9701-04 | NOV | Failure to adequately monitor unavailability for the instrument air system (Section M1.6) |
| 416/9701-05 | NCV | Failure to adequately monitor unavailability for two systems (Section M1.6) |

## LIST OF DOCUMENTS REVIEWED

### PROCEDURES

| PROCEDURE NUMBER | REVISION NUMBER | TITLE |
|---|---|---|
| 01-S-18-1 | 0 | Work Planning and Coordination, dated 2/26/97 |
| 04-1-01-E30-1 | 100 | Suppression Pool Makeup System |
| 04-1-01-P41-1 | 100 | Standby Service Water System |
| 04-1-01-P81-1 | 100 | High Pressure Core Spray Diesel Generator |
| 04-1-01-P75-1 | 100 | Standby Diesel Generator System |
| 05-S-01-EP-2 | 23 | RPV Control |
| 05-S-01-EP-3 | 23 | Containment Control |
| 05-1-02-I-4 | 23 | Loss of AC Power |
| 05-1-02-V-9 | 24 | Loss of Instrument Air |
| 05-1-02-V-11 | 21 | Loss of Plant Service Water |
| 06-OP-1E30-Q-0001 | 100 | Suppression Pool Makeup Valve Operability Test |

| PROCEDURE NUMBER | REVISION NUMBER | TITLE |
|---|---|---|
| 06-OP-1E30-M-0002 | 100 | Suppression Pool Makeup Monthly Valve Position Test |
| 06-OP-1P41-Q-0004 | 100 | Standby Service Water (SSW) Loop A Valve and Pump Operability Test |
| 06-OP-1P41-Q-0005 | 100 | Standby Service Water (SSW) Loop B Valve and Pump Operability Test |
| 06-OP-1P41-Q-0006 | 100 | HPCS Standby Service Water Valve and Pump Operability Test |
| 06-OP-1P75-M-0001 | 100 | Standby Diesel Generator (SDG) 11 Functional Test |
| 06-OP-1P75-M-0002 | 100 | Standby Diesel Generator (SDG) 12 Functional Test |
| 06-OP-1P81-M-0002 | 100 | HPCS Diesel Generator 13 Functional Test |
| 17-S-03-28 | 1 | Maintenance Rule Program |
| DT-03-02 | 4 | Maintenance Rule Coordinator Desk Top Procedure |
| GGNS-91-0059 | 0 | Grand Gulf Nuclear Station Engineering Report For At-Power PS: P43-Turbine Building Cooling Water System Notebook |
| GGNS-96-0044 | 0 | Grand Gulf Nuclear Station Engineering Report For At-Power PSA: AC Power System Notebook |
| GGNS-96-0051 | 0 | Grand Gulf Nuclear Station Engineering Report For At-Power PSA: Power Conversion System Notebook |
| GGNS-C-399.0 | 1 | Maintenance Rule for Structures |
| OP-LO-DT-LP-0008 | 100 | Loss of AC Power |
| OP-LO-DT-LP-0014 | 100 | Inadvertent HPCS Startup |
| OP-LO-SYS-LP-E30-04 | 100 | Suppression Pool Makeup System |
| OP-LO-SYS-LP-P41-05 | 100 | Standby Service Water System |
| OP-LO-SYS-LP-P75-05 | 100 | Standby Diesel Generator System |
| OP-LO-SYS-LP-P81-04 | 100 | HPCS Diesel Generator System |

## OTHER DOCUMENTS

Root Cause Analysis Reports

RCAR 95-24
RCAR 95-26

Material Nonconformance Reports

MNCR 0265-93
MNCR 0119-95
MNCR 0254-95

Condition Reports

CR 1996-0260-00
CR 1996-0260-01
CR 1996-0294-00
CR 1997-0029-00

Other References

CAFTA Data Base - Free Format Report
Daily Plant Status Report (03/03-06/97)
Expert Panel Charter and Meeting Minutes
Failure Data Base
Maintenance Rule Data Base
Maintenance Rule White Paper - Reliability Monitoring Technical Basis
Presentation to Maintenance Rule Expert Panel on Grand Gulf Nuclear Station Level 2 Probabilistic Risk Assessment, September 20, 1995

Quality Deficiency Reports

QDR 0136-95
QDR 0064-96
QDR 0294-96